3. CONTAMINATION SITE CPP-81

Information presented in the following subsections was extracted from *Track 1 Documentation Decision Packages for WAG 3 OU 3-12 Site CPP-81* (WINCO 1994) and the white paper evaluation by SAIC (SAIC 2000b).

3.1 Summary

Site CPP-81 (abandoned CPP-637/CPP-620 vessel off-gas [VOG] line) is an abandoned 68-ft section of a VOG line (3-in. VGA-100) (see Figures 1-1 and 3-1). The abandoned VOG line is located 2-3 ft below Building CPP-637/620, High/Low Bay Laboratory, running east under an asphalt pad. The Track 1 decision documentation (WINCO 1994), approved in 1994, determined that "No Further Action" was justified for the abandoned VOG line. At the time of issuing the OU 3-13 ROD, Site CPP-81 was transferred to OU 3-14 for further evaluation (DOE-ID 1999).

3.2 Incident

The VOG line became partially plugged in October 1986 during Run #15 of the 30-cm-diameter Calciner Pilot Plant with simulated (nonradioactive) fluorinel pilot plant calcine. A new VOG line was rerouted around the partially plugged portion of the VOG line. The upstream end of the abandoned VOG line was capped and the downstream end of the VOG line remained connected to the plant VOG system.

Calcine from Run #15 contained concentrations of heavy metals cadmium and chromium as described in the Track 1 decision document (WINCO 1994). Other potential materials that may have been present in the VOG line from previous runs were compiled as a reference to the Track 1 decision document (see Reference 1 of WINCO 1994). Based on process data, the pipe potentially was contaminated with zirconium, chromium, calcium, chloride, fluoride, potassium, sodium nitrate, sulfate, aluminum, boron, mercury, lead, hexone, tributylphosphate, AMSCO, U-238, and U-235 and cobalt, strontium, cesium, and cerium as nonradioactive nitrates.

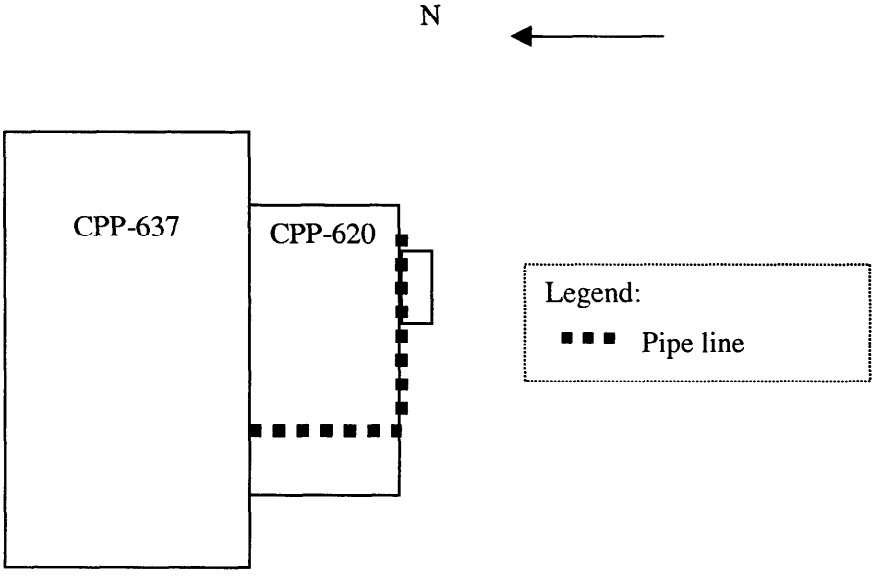

Figure 3-1. Approximate CPP-81 location; 3-in. VOG line located 2-3 ft below CPP-620 running east under an asphalt pad.

3.3 CERCLA Time-Critical Removal Action

In September 1993, the VOG line was disconnected from the plant VOG system and flushed with heated, 8 M nitric acid/aluminum nitrate solution for about 30 hr to remove the simulated calcine and any hazardous materials. Table 3-1 presents a sample of the calcine compositions (from Reference 4 of WINCO 1994). The VOG line flush consisted of 5 nitric acid washes and 14 water rinses. The initial acid wash revealed cadmium and chromium concentrations of 465 ppm and 190 ppm, respectively (see Table 3-2). The final water rinse revealed concentrations of cadmium and chromium of 0.17 ppm and 0.11 ppm, respectively (see Table 3-3). The maximum Resource Conservation and Recovery Act (RCRA) toxicity characteristic regulatory levels (40 CFR 261.24) for these are 1.0 mg/L cadmium and 5.0 mg/L chromium (see Reference 6 of WINCO 1994). Laboratory analysis for suspected trace compounds was not conducted.

No leaks were observed during the removal action, indicating that no previous release to the environment had occurred during the 1986 Run # 15 or during the flushing operation. Calculations using data collected during the removal were used to estimate the amount of simulated calcine removed from the line. Approximately 52 kg of simulated calcine were removed by dissolution (see Appendix D). This removal of plugged material was confirmed when no solids were observed in the VOG line during the post-removal inspection. The VOG line was capped and abandoned in place.

3.4 Documentation History

The Track 1 decision documentation (WINCO 1994) approved in 1994 determined that no further action is required with regard to Site CPP-81. This determination was evaluated and approved by DOE-ID, IDEQ, and EPA Region X. The decision to transfer this "No Further Action" site to OU 3-14 in the OU 3-13 ROD was based on uncertainties regarding the extent, if any, of residual trace compounds indicated in the process data, such as mercury, that were not analyzed in the final water rinse. The document also notes that it is anticipated that a final decision can be reached based on documented historical information.

3.5 Site Evaluation

Decision drivers for the Track 1 (WINCO 1994) included VOG line water testing for integrity, acid flushing for removal of solids and hazardous materials, and visual inspection of a VOG line section that was observed to contain solid materials before the acid flushing and was visually inspected after the fifth acid flushing to be free of solid materials. Analysis of the final rinse water was used to verify that the abandoned VOG line no longer contained hazardous contaminants at concentrations above the maximum RCRA toxicity characteristic regulatory levels (40 CFR 261.24).

3.5.1 Nature and Extent of Remaining Contamination

The abandoned VOG line contains no hazardous contaminants at concentrations above RCRA toxicity characteristic regulatory levels of concern (40 CFR 261.24).

- Evidence indicates there have been no uncontrolled releases from the clogged VOG line. This is substantiated by the water test and subsequent acid/water flush corrective action, as there was no fluid loss during the water test or subsequent flushing runs.
- The analytical data from the final water wash (Table 3-3) clearly indicate that the cadmium and chromium concentrations were reduced to levels below regulatory concern.

Table 3-1. Sample calcine composition.

Sample Calcine Compositions

Icine	Location	Quantity Product	Quantity Fines	wt % Al	B	Ca	Cd	Ce	Cl	Cr	Cs	F	Fe	Hg	K	Na	NO3	PO4	Sn	SO4	Sr	Y	Zr		Log #
n 2 Zr	NNCF????	126.5 lb?																							
	UE		300.2 lb		5.76	1.626	29.40	<0.05	<0.05	<0.025	0.447	0.015	19.89	0.268	<0.0005	0.015	0.36	0.56				0.040		15.70	Fines	045
n 30 & 46	??????		10.6 lb																						
n 4A	??????	19.3 lb	Samples		47.90	0.220											0.28							Product	
					46.20	0.170											0.24							Fines	
n 4 Al-Na-Fe	??????	87.0 lb																							
n 5B Zr	NNCF	50.9 lb			17.82	0.730	22.36	0.368			0.279	0.012	14.05		<0.0005	0.089	0.64					0.168		12.56	Product	1016
n 5B Al	Cargo A	81.4 lb			18.51	0.390	18.55	<0.028		<0.025	0.138	0.053	6.21	2.435	<0.0005	0.385	0.63	0.40				0.024		10.93	Product	1041
	Cargo A		24.4 lb		45.55	0.374	0.29	0.009	<0.005	<0.025	0.012	0.005	0.18	0.079	<0.0005	0.024	0.42	3.60				<0.005		0.07	Fines	1012
n 13	??????		183.8 lb		4.30	0.650	23.30	8.050					10.70				3.90	10.70			4.83			14.40	Product	
14 Zr	NNCF	89.2 lb			3.65	0.440	26.20	4.950			0.620	0.005	12.23			0.530	3.40					0.030		11.30	Product	1023
	UE		57.5 lb																					Fines	1043
n 17	Cargo A	137.9 lb			5.01	0.560	25.02	4.570		0.230	0.800		19.03			0.940	4.10	5.97			3.10			10.77	Product	1040
	Cargo A		103.5 lb		5.01	0.650	21.07	4.259		0.340	1.310	0.900	12.39				4.60	4.86			3.46			14.69	Fines	1041
n 18 Fl-Na	??????		205.3 lb		5.37	0.690	25.30	5.220		0.150			14.44			0.540	2.30	5.70			0.06			13.39	Product	
					4.50	0.940	21.20	4.050		0.260			15.05			0.770	3.20	9.22			1.49			14.38	Fines	
n 19 Al-Na	Cargo A	142.5 lb			33.20	1.665	5.27	0.238	<0.005	0.056	0.127	0.006	3.46	0.229	<0.0005	0.960	3.75	6.60				0.054		2.83	Product	1036
	UE		25.8 lb		21.25	0.870	14.54	1.790	<0.005	0.112	0.494	0.006	9.58	0.225	<0.0005	0.705	2.80	6.41				0.199		7.55	Fines	1035
n 20 Fl-Na-Al	Cargo A	289.0 lb			21.50	2.070	15.30	1.570		0.330	0.557		11.58			0.860	3.80							7.99	Product	1039
	Cargo A		96.0 lb		22.00	2.120	13.90	2.175		0.450	0.674		9.32			0.870	4.00							8.30	Fines	1038
	UE		338.8 lb																						
n 6?	NNCF	83.2 lb			7.70	2.400	25.80	<0.005			0.329		17.90											16.50	Product	011
					7.50	1.400	28.50						18.50											16.20	Fines	
n 6A	Cargo A	141.0 lb			10.50	0.960	32.50	<0.005		0.030	0.240		10.60	0.750			2.10	4.36			1.50			13.20	Product	009
	Cargo A		35.6 lb		6.60	0.680	24.60	0.005		0.150	0.459		15.20	1.300			4.49	8.15			1.70			11.00	Fines	029
n ?A	????	591.2 lb																							

Table 3-2. Species concentrations for the first series of acid and water flushes.

SAMPLE	AF-1	AF-2	B1	B2	B3	B4	AF-B1	W-1	W-2	W-3	W-4	W-5	W-6	
VOLUME (gal)	100	100	60	80	50	100	60	50	50	50	50	50	50	(gal)
SPECIES														
Acid (N)	3.999	1.46	0.1695	0.1855	0.1855	0.1695	0.678	0.236	0.1535	0.1695	0.241	0.1535	0.1535	Acid (N)
Al (M)	0.319	0.133	0.0054	0.0036	0.00334	0.00138	0.169	0.0215	0.006	0.0034	0.0063	0.0024	0.0162	Al (M)
Ca (mg/l)	5550	4750	1039	233	231	131.8	1966	1719	1651	494	669	100	759	Ca (mg/l)
Cd (ppm)	485	299	38.3	35.4	46.9	30.3	153	424	424	31.2	88.5	88.5	164.7	Cd (ppm)
Cl (mg/l)	7.5	25.2	36.8	19.1	18	18	22.2	19.4	19.5	18.3	17.6	18	19.1	Cl (mg/l)
Cr (ppm)	189.6	146.6	59.5	10.5	10.5	10.5	99.7	51	51	11.3	21.6	10.5	32.2	Cr (ppm)
F (mg/l)	12250	8891	372	298.8	163.4	64.2	4256	1549	707	338	510	38.6	773	F (mg/l)
NO3 (M)	4.87	1.74	0.087	0.167	0.0351	0.0112	1.15	0.204	0.0638	0.0312	0.0498	0.0043	0.0634	NO3 (M)
SO4 (mg/l)	444	480	167	94.1	106	45	249	235	144	81	77	7.8	99.8	SO4 (mg/l)
UDS (gm/l)	1.54	1	2.86	1.5	0.3555	0.09	1.31	0	0	1.18	0	0	0	UDS (gm/l)
U (mg/l)	0.92	0.325	0.325	0.325	0.325	0.325	0.325	0.449	0.449	0.325	0.449	0.449	0.449	U (mg/l)
Zr (M)	0.0262	0.0303	0.0055	0.0017	39.8	26.3	0.0161	0.011	0.0052	0.0023	0.0032	0.0023	0.0022	Zr (M)
Al/F ratio	0.495	0.284	0.276	0.228	0.3884	0.4024	0.754	0.264	0.16	0.191	0.233	0.194	0.3975	Al/F ratio

NOTE: [redacted] blocks are less than values reported by analytical that have been used as real values.

SAMPLE IDENTIFICATION

Run #1:	**Acid Flushes**	**Water Rinses**
	AF-1	B1
	AF-2	B2
		B3
		B4

Run #2	**Acid Flush**	**Water Rinses**
	AF-B1	W-1
		W-2
		W-3
		W-4
		W-5
		W-6

Table 3-3. Species concentrations for the second series of acid and water flushes.

Final (water) Flush TCLP

SAMPLE VOLUME (gal SPECIES	C-3 50	D-4 80	E-1 50	E-2 50	E-3 50	E-4 50	Composite 1180	(gal)
Acid (N)	4.31	1.72	0.296	0.296	0.296		0.9300	Acid (N)
Al (M)	1.07	1.13	0.107	0.0216	0.0035	0.0003	0.1775	Al (M)
Ca (mg/l)	9730	2326	691	305	107		1907.6271	Ca (mg/l)
Cd (ppm)	155	73.5	73.5	73.5	73.5	0.17	153.6555	Cd (ppm)
Cl (mg/l)	37.5	150	30	30	30	18	29.9220	Cl (mg/l)
Cr (ppm)	44.6	87.9	25.5	25.5	25.5	0.112	56.8056	Cr (ppm)
F (mg/l)	10100	3534	693	308	56	19.5	2938.6432	F (mg/l)
NO3 (M)	6.32	4.36	0.422	0.076	0.0132	0.0014	1.2396	NO3 (M)
SO4 (mg/l)	287	50.2	6.2	14.1	20.8	27.5	159.9271	SO4 (mg/l)
UDS (gm/l)	0.0013	0.0013	0.0013	0.0013	0.0013	0.263	0.6131	UDS (gm/l)
U (mg/l)	0.325	0.325	0.325	0.325	0.325	0.05	0.3900	U (mg/l)
Zr (M)	0.0446	0.0127	0.0033	0.0012	0.0007	0.00003	3.9253	Zr (M)
Al/F ratio	2.01	6.08	2.93	1.332	1.198	0.292	0.9865	Al/F ratio

NOTE: [redacted] blocks are less than values reported by analytical that have been used as real values.

SAMPLE IDENTIFICATION

Run #3	Acid Flushes	Water Rinses
	C-3	E-1
	D-4	E-2
		E-3
		E-4

NOTE: C-3 and D-4 acid runs utilized the altered nitric acid/aluminum nitrate solution.

- Although final water wash analytes did not include the trace compounds that process data indicated may be present in the VOG line from past operations, it is correct to assume, based on the chemical similarities of cadmium and mercury, that the rigorous nature of the multiple nitric acid washes would render the concentrations of suspected trace compounds to levels well below regulatory concern.

  No mercury had been used for at least 2 years prior to the line plug. The line plug was caused by a known failure of a rupture disk which allowed bulk quantities of calcine to enter the off-gas. Without failure of the rupture disk, only trace quantities of calcine could enter the line. If trace quantities of calcine material from previous simulated calcine runs were present in the line, this material would have contained mercury. In review of the documentation of pilot plant runs that used mercury in the composition of the simulated calcine (Newby 1979, Newby 1980), the level of mercury in the calcine fines that might have been in the off-gas system would not have exceeded 20 ppm. Since mercury and cadmium are chemically similar and are both soluble in nitric acid, the acid flushes which removed the cadmium would have removed a similar proportion of any mercury present. The decontamination factor that was demonstrated for cadmium during the flushes was greater than 2500 (i.e., 465 mg/L Cd level at initial decontamination ÷ 0.17 mg/L Cd level at final decontamination). Since the initial mercury concentration in the calcine fines before dissolution would have been at most 20 ppm, the expected remaining maximum mercury concentration would be 0.008 ppm (20 ppm ÷ 2500). This is significantly less than the integrated HQ of 1 (23 ppm). In addition, the maximum TCLP leachate concentration would be 0.0004 mg/L [0.008 ÷20 (20X rule)]. This is well below the maximum RCRA toxicity characteristic regulatory level (40 CFR 261.24) for mercury of 0.2 mg/L TCLP, so the statement that the hazardous materials had been removed is justified.

- The postulated trace quantities of organic contaminants, hexone, tributylphosphate, AMSCO, and kerosene from previous experiments and pilot plants connected to the VOG are not realistic (Reference 1 of WINCO 1994). The other pilot plants connected to the VOG were not in operation during the plugging incident. The pilot plant autoignition tests were performed by injecting the organic into a fluidized bed at >300°C. The organic would have entered the line as vapor and passed on through without depositing in the line. Solvent extraction pilot plants operated at room temperature, and the only way liquids (organic or aqueous) could have entered the off-gas would have been through evaporation. The organic compounds used (including hexone) have vapor pressures comparable to water. In addition, there is a demister in the line that prevents any liquid droplets, generated by splashing, etc., from entering the off-gas piping.

3.5.2 Contaminant Risk

To assess the risk at CPP-81 from residual contaminants, the PRGs from EPA Region IX were used (EPA 2000). The PRGs are Agency guidelines, not legally enforceable standards. They are used for site "screening" and as initial cleanup goals if applicable.

The PRGs contained in the Region IX PRG table are generic; they are calculated without site-specific information. They can be used to screen a site to determine whether further evaluation is appropriate. Exceeding a PRG suggests that further evaluation (i.e., additional sampling) of the potential risks that may be posed at the site is appropriate. Region IX PRG concentrations are based on exposure pathways for which generally accepted methods, models, and assumptions have been developed (i.e., ingestion, dermal contact, and inhalation) for specific land-use conditions and do not consider impact to groundwater or ecological receptors. The PRGs are chemical concentrations that correspond to fixed levels of risk [i.e., either a one-in-one million (10^{-6}) cancer risk or a noncarcinogenic hazard quotient of 1 in soil, air, and water].

The most conservative concentrations giving a 10^{-6} cancer risk and a HQ equal to 1 are for the residual amounts of cadmium and compounds, total chromium, chromium III, chromium IV, and mercury and compounds are presented in Tables 3-4 and 3-5 for residential and industrial scenarios, respectively.

The risk represented by any residual of cadmium and compounds (0.17 mg/kg), total chromium (0.112 mg/kg), chromium III, chromium IV, and mercury and compounds (0.05 mg/kg) does not exceed a cancer risk of 1E-06 or a HQ = 1 for the residential and industrial preliminary remediation goal (see Tables 3-4 and 3-5).

Table 3-4. The contaminant concentrations [mg/kg (ppm)] for residential soil—10^{-6} cancer risk and HQ = 1 (adapted from EPA 2000).

	Residential Soil							
	Cancer Risk = 1E-06				Chronic HQ = 1			
Contaminant	Soil-inhale (mg/kg)	Soil-dermal (mg/kg)	Soil-ingest (mg/kg)	Integrated (mg/kg)	Soil-inhale (mg/kg)	Soil-dermal (mg/kg)	Soil-ingest (mg/kg)	Integrated (mg/kg)
Cadmium and compounds	1.4E+3	—	—	1.4E+3	—	7.0E+02	3.9E+01	3.7E+01
Total chromium (1:6 ratio Cr VI:Cr III)	2.1E+02	—	—	2.1E+02	—	—	—	—
Chromium III	—	—	—	—	—	—	1.2E+05	1.2E+05
Chromium VI	3.0E+01	—	—	3.0E+01	—	—	2.3E+02	2.3E+02
Mercury and compounds	—	—	—	—	—	—	2.3E+01	2.3E+01
Mercury (elemental)	—	—	—	—	—	—	—	—

a. — = No data available.

Table 3-5. The contaminant concentrations (mg/kg [ppm]) for industrial soil—10^{-6} cancer risk and HQ = 1 (adapted from EPA 2000).

	Industrial Soil							
	Cancer Risk = 1E-06				Chronic HQ = 1			
Contaminant	Soil-inhale (mg/kg)	Soil-dermal (mg/kg)	Soil-ingest (mg/kg)	Integrated (mg/kg)	Soil-inhale (mg/kg)	Soil-dermal (mg/kg)	Soil-ingest (mg/kg)	Integrated (mg/kg)
Cadmium and compounds	3.0E+03	—	—	3.0E+03	—	3.9E+03	1.0E+03	8.1E+02
Total chromium (1:6 ratio Cr VI:Cr III)	—	—	—	—	—	—	—	—
Chromium III	4.5E+02	—	—	4.5E+02	—	—	—	—
Chromium VI	—	—	—	—	—	—	3.1E+06	3.0E+06
Chromium VI	6.4E+01	—	—	6.4E+01	—	—	6.1E+03	6.1E+03
Mercury and compounds	—	—	—	—	—	—	6.1E+02	6.1E+02
Mercury (elemental)	—	—	—	—	—	—	—	—

a. — = No data available.